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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/816,503	04/01/2004	Hong-Jyh Li	2004P51130US/1331.128.101	8623

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EXAMINER

JOHNSTON, PHILLIP A

ART UNIT	PAPER NUMBER
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2881

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/816,503

Applicant(s)

LI, HONG-JYH

Examiner

Phillip A. Johnston

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Detailed Action

1. This Office Action is submitted in response to the amendment filed 10-10-2006, wherein claims 1-31 are pending.

2. The examiner agrees with those arguments presented in the remarks filed 10-10-2006 regarding the examiners failure to clearly point out each and every limitation of the applicants claimed invention. As a result, the rejection in the previous Office Action is withdrawn, and a new Office Action is submitted below which will more clearly define the examiners position.

Claims Rejection – 35 U.S.C. 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,518,195 to Collins, in view of Jeon, U.S. Patent No. 6,790,755.

5. Regarding claims 1 and 8, Collins teaches plasma reactor 10 (Note Figure 1 below) having the following claimed elements;

(a) Vacuum chamber 11. Col. 7, line 8-11;

(b) Vacuum pump 21. Col. 7, line 28-33;

(c) Gas supplied through manifold G1. Col. 7, line 35-50;

(d) Plasma chamber 16A for coupling the RF electromagnetic (em) energy into the source chamber 16A to induce electric fields to ionize the process gas.

Col. 8, line 39-53;

(e) Plural power supplies, where AC supply 31 provides RF for plasma generation to antenna 31 at the top of the chamber and at the bottom, power supply 42 provides a constant positive or negative DC bias between the sample holder and the chamber wall (Col. 11, line 60-67), where a negative bias extracts positive ions toward (accelerate) wafer 5, and repels negative ions; and

(f) Wafer support electrode 32C (sample holder). Col. 8, line 55-60;

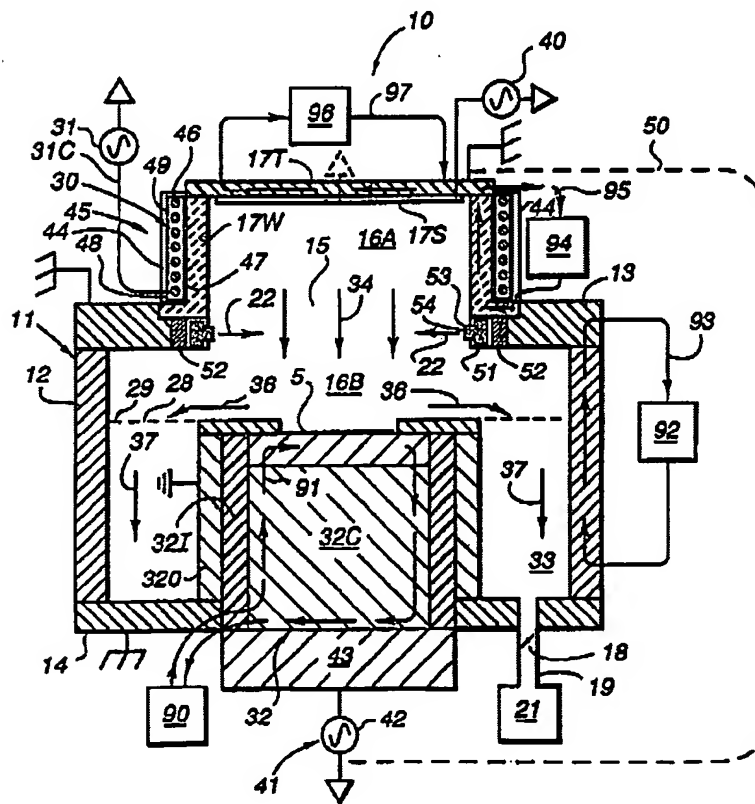


FIG. 1

6. Collins teaches all the required limitations of claims 1 and 8, as pointed out above.

7. Collins fails to disclose implanting ions into a high-k dielectric layer having a k value greater than 9.

8. Jeon teaches Nitrogen ion implantation after deposition of alternating sub-layers of high-k dielectric and standard-k dielectric materials on a semiconductor substrate. The high-K dielectric materials have a K value of about 20 or more. Such high-K dielectric materials include, for example, HfO_2 , ZrO_2 , and Ta_2O_5 . Col. 4, line 1-10; Col. 14, line 9-20.

9. Jeon modifies Collins to provide nitridation of high-k dielectric layers to produce semiconductor devices having the electrical advantages of a higher K.

10. Therefore it would have been obvious to one of ordinary skill in the art that the plasma reactor apparatus of Collins can be modified to use ion implantation of high-k layers in accordance with Jeon, to provide a semiconductor device having a composite dielectric layer, where the composite dielectric layer is formed about the boundary of each first dielectric material layer/second dielectric material layer.

11. Regarding claim 16, the combination of Collins and Jeon teaches all the required limitations therein as pointed out above regarding claims 1 and 8. Regarding implanting ions comprising one of F, Si, O, Hf, Zr, Ti, Ta, Y, V, Sc, Ba, Sr, Ru, B, Al, Ga, In, Ge, C, P, As, and Sb, the examiner takes official that it is well known in the art to implant ions selected from one of the group above. See USPN 2001/0054746 to Yamada. Therefore one of ordinary skill would select an ion to be implanted from the

group above in order to provide doping levels for production of desired semiconductor device characteristics.

12. Regarding claim 25, the combination of Collins and Jeon teaches all the structural elements therein as described above regarding claims 1 and 8. Collins also teaches evacuation of the interior of the chamber housing 11 (chamber 16) controlled by a throttle valve 18 in a vacuum line 19 connected to vacuum pumping system 21. Col. 7, line 28-33.

13. Regarding claims 2 and 10, the rationale applied above to claims 1 and 8 also applies to claims 2 and 10.

14. Regarding claims 3 and 11, the rationale applied above to claim 16 also applies to claims 3 and 11.

15. Regarding claims 4-7, the combination of Collins and Jeon teaches all the required limitations therein as described above regarding claims 1 and 8. Collins also teaches power supply 42 is also configured to supply AC voltages. Col. 8, line 55-60.

16. Regarding claim 9, the rationale applied above to claims 1 and 8 also applies to claim 9.

17. Regarding claim 12, the rationale applied above to claims 1 and 8 also applies to claim 12.

18. Regarding claims 13-15, and 20-22, the combination of Collins and Jeon teaches all the required limitations therein as described above regarding claims 1, 8 and 16. The examiner takes Official Notice that all the limitations in claims 13-15, and 20-22 are well known in the semiconductor process art. See USPN 2001/0054746 to

Yamada. Therefore it would have been obvious to one of ordinary skill to provide plural buffer layers on silicide stacks that include metals such as titanium (Ti) or cobalt (Co), and implanting ions in the buffer layers to adjust doping levels.

19. Regarding claim 17, the rational applied above to claim 16 also applies to claim 17. The combination of Collins and Jeon teaches plasma processing of large semiconductor wafers, which inherently includes a pattern of adjacent devices, thus would also include the use of adjacent high-k dielectric layers.

20. Regarding claims 18 and 19, the combination of Collins and Jeon teaches all the limitations therein as pointed out above regarding claim 16.

21. Regarding claims 23 and 24, the rational applied above to claims 4-7, and 16, also applies to claims 23 and 24.

22. Regarding claim 26, the rational applied above to claim 25, and claims 2 and 10, also applies to claim 26.

23. Regarding claim 27, the rational applied above to claim 25, and claims 3 and 11, also applies to claim 27.

24. Regarding claims 28 and 29, the rational applied above to claims 4-7, and 25, also applies to claims 28 and 29.

25. Regarding claim 30, the rational applied above to claim 25 also applies to the structural elements of claim 30. The examiner takes Official Notice that implanting a dose greater than 1×10^{13} ions/cm² and less than 1×10^{16} ions/cm² is well known in the semiconductor process art. See USPN 6,130,135 to Wu. Therefore it would have been obvious to one of ordinary skill to implant ions such as boron in the dosage

range from about 1×10^{13} to $5 \times 10^{13} \text{ cm}^2$

26. Regarding claim 31, the rationale applied above to claim 25 also applies to the structural elements of claim 31. The examiner takes Official Notice that implanting with an implant energy within a range of 5 eV to 10 keV is well known in the semiconductor process art. See USPN 6,130,135 to Wu. Therefore it would have been obvious to one of ordinary skill to implant dopants such as arsenic or phosphorus at energies ranging from about 20 to 150 KeV.

Conclusion

27. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Drew Dunn can be reached at (571)272-2312. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

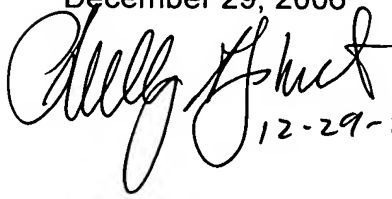
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you have questions on access to the Private PAIR system, contact the Electronic
Business Center (EBC) at 866-217-9197 (toll-free).

PJ

December 29, 2006


12-29-2006